PAPER FEEDER

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to paper feeders for use in image forming apparatus adapted to form images on recording sheets, such as facsimile apparatus, printers, copying machines and printing machines. More particularly, the invention relates to a paper feeder operative to bring the leading edge of each of recording sheets fed one by one by means of a separating rubber member and a sheet feeding roller both disposed at a location corresponding to a widthwise central portion of a recording sheet to be fed into contact with a skew correction roller in a temporarily rotation-halted state in order to correct possible skew of each recording sheet before image formation.

Description of the Related Art

Among conventional paper feeders for use in image forming apparatus such as facsimile apparatus, printers, copying machines and printing machines, those paper feeders of the type constructed to feed recording sheets one by one separately by means of a separating rubber member and a sheet feeding roller both disposed at a location corresponding to a widthwise central portion of a recording sheet to be fed may cause a recording paper being fed to be skewed due to the feeding force of the sheet feeding roller working on a

widthwise central portion of the recording sheet. To correct such a skew a conventional paper feeder of the aforementioned type brings the leading edge of a recording sheet into contact with a roller having a length comparable to the entire width of the recording sheet such as a platen roller or a resist roller in a temporarily rotation-halted state.

Fig. 4 shows an example of such a conventional paper feeder. In this figure reference numerals 2, 3, 4, 5, 7 and 8 denote a tray, a recording sheet stack, a separating rubber member, a sheet feeding roller, a platen roller and a printing set, respectively. A lowermost recording sheet 3a is separated from the recording sheet stack 3 placed on the tray 2 by means of the separating rubber member 4 and then fed by the sheet feeding roller 5 until the leading edge thereof is brought into contact with the platen roller 7 in a temporarily rotation-halted state.

Thereafter, the platen roller 7 starts rotating to feed the recording sheet 3a as caught between the platen roller 7 and the printing set 8 for the recording sheet 3a being fed to subjected to printing. Since the feeding force of the sheet feeding roller 5 works on the recording sheet 3a until the platen roller 7 starts rotating, the leading edge portion of the recording sheet 3a becomes slightly deflected.

If the recording sheet 3a is skewed when the leading edge thereof is brought into contact with the platen roller 7 halted, the contact between the recording sheet 3a and the

platen roller 7 is made on one side. If the recording sheet 3a has sufficiently high stiffness, the recording sheet 3a overcomes the restraining forces of the separating rubber member 4 and sheet feeding roller 5 by virtue of reaction force resulting from the one-sided contact, with the result that the posture of the recording sheet 3a is corrected to become orthogonal to the platen roller 7.

As another type of paper feeder, a sheet feeder proposed, for example, in Japan Patent Laid Open Publication hei No. 7-10317 includes upper and lower sheet guide means provided in the enclosure of the feeder for guiding recording sheets, at least the upper sheet guide means facing a recording sheet being formed from a flexible material so as to be flexibly deformable in accordance with loops of different shapes that can be formed by recording sheets of different qualities.

With the conventional paper feeder shown in Fig. 4, however, if the recording sheet 3a has insufficient stiffness (limp), reaction force insufficient to correct skew results when the recording sheet 3a is brought into contact with the platen roller 7 on one side, so that the recording sheet 3a is deflected largely, which causes the recording sheet 3a to become buckled and waved. In the subsequent printing operation the recording sheet 3a kept waved is caught between the platen roller 7 and the printing set 8, so that printing is made on the recording sheet 3a wrinkled. Thus,

conventional paper feeders of this type involve a problem that they cannot use thin recording sheets having low stiffness.

With the sheet feeder described in the aforementioned patent publication, it is not easy even for the guide means formed from a flexible material to accommodate all paper qualities flexibly. It is feared that there will be cases where the guide means cannot be deformed sufficiently to accommodate deflection of a very thin recording sheet having very low stiffness and hence is incapable of canceling a waved state of the recording sheet. In such cases, it is also feared that the flexible guide means facilitates jamming during feeding.

The present invention, which has been made in view of the foregoing circumstances, intends to provide a paper feeder which is always capable of properly feeding recording sheets without causing such a recording sheet to buckle even if they are very thin recording sheets having low stiffness.

SUMMARY OF THE INVENTION

In accordance with the present invention, there is provided a paper feeder comprising: a sheet feeding roller disposed upstream of a skew correction roller in a sheet feeding direction at a location corresponding to a widthwise central portion of a recording sheet; a separating rubber member disposed as opposed to the sheet feeding roller; and buckling preventive mechanism extending over opposite sides of

the separating rubber member for preventing the recording sheet from being deflected during feeding of the recording sheet by the sheet feeding roller.

With a conventional paper feeder, if a recording sheet to be fed has low stiffness, an insufficient skew correcting force results when the recording sheet is brought into contact with a skew correction roller on one side, so that the recording sheet is deflected largely, which causes the recording sheet to become buckled and waved. Thus, such a conventional paper feeder has a drawback of being incapable of ensuring satisfactory printing.

In the paper feeder constructed according to the present invention the provision of the buckling preventive mechanism extending over opposite sides of the separating rubber member makes it possible to prevent a recording sheet passing through the buckling preventive mechanism from being deflected. For this reason, the paper feeder of the present invention first prevents even a thin recording sheet having low stiffness from being deflected and then brings the leading edge thereof into contact with the skew correction roller halted.

Consequently, the reaction force resulting from one-sided contact of the recording sheet with the skew correction roller is transmitted to the region where the separating rubber member and the sheet feeding roller are located, thereby correcting the posture of the recording sheet.

For this reason, unlike the conventional paper feeder, the paper feeder of the present invention does not cause even a thin limp recording sheet to wrinkle and hence ensures satisfactory printing thereon.

Specifically, the buckling preventive mechanism may comprise a deflection preventive sheet comprising a thin flexible sheet having certain rigidity, and a base plate of a feeder body, the deflection preventive sheet and the base plate defining therebetween a gap established to permit the recording sheet to pass therethrough with a clearance.

Since this feature permits a recording sheet to pass through the gap defined between the deflection preventive sheet comprising the thin flexible sheet having certain rigidity and the base plate of the feeder body with a clearance, the paper feeder can inhibit even a thin recording sheet having low stiffness to be deflected and hence can prevent the recording sheet from buckling.

The deflection preventive sheet may comprise a stiff portion having relatively high stiffness and a contact portion having relatively low stiffness and positioned downstream of the stiff portion.

By thus positioning the contact portion having relatively low stiffness downstream of the stiff portion having relatively high stiffness a recording sheet can be inhibited to wave more effectively as waves become larger and, hence, the occurrence of buckling of the recording sheet

becomes less likely.

The contact portion of the deflection preventive sheet may be formed with slits on opposite sides of the separating rubber member so as to be imparted with enhanced flexibility.

The slits formed in the contact portion make it possible to enhance the flexibility of the contact portion, thereby allowing the deflection preventive sheet to accommodate large waving of the recording sheet more effectively.

Further, the slits are utilizable also as openings allowing an operation of securing the separating rubber member and a mount for mounting the deflection preventive sheet mount thereon to an upper lid of the feeder body with screws to be performed therethrough.

By utilizing the slits of the deflection preventive sheet as openings allowing an assembling operation to be performed therethrough, the paper feeder can be assembled with remarkably improved operability.

The foregoing and other objects, features and attendant advantages of the present invention will become more apparent from the reading of the following detailed description of the invention in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view showing a paper feeder embodying the present invention;

Fig. 2 is a perspective view of buckling preventive mechanism of the paper feeder;

Fig. 3 is a perspective view showing a facsimile apparatus provided with the paper feeder; and

Fig. 4 is a perspective view showing a conventional paper feeder.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Hereinafter, the present invention will be described in detail by way of embodiments thereof with reference to the accompanying drawings.

Referring first to Fig. 3, there is shown a facsimile apparatus as an example of image forming apparatus employing a paper feeder according to the present invention. The facsimile apparatus shown includes a facsimile apparatus body 1 and a sheet feeding tray 2 fitted on the rear side of the facsimile apparatus body 1 for receiving a stack of recording sheets thereon. The paper feeder of the present invention is constructed as shown in Fig. 1 for example. The parts shown in Fig. 1 include the sheet feeding tray 2, a recording sheet stack 3, a separating rubber member 4, a sheet feeding roller 5, a deflection preventive sheet (ASF sheet) 6 for inhibiting each recording sheet to buckle, a platen roller 7, a printing set 8, a mount 9, and a base plate 10.

The separating rubber member 4, sheet feeding roller 5 and deflection preventive sheet 6 are disposed at a location corresponding to a widthwise central portion of the recording sheet stack 3. The separating rubber member 4 is operative to separate a lowermost recording sheet 3a from the recording sheet stack 3 placed on the sheet feeding tray 2, and the recording sheet 3a thus separated is fed by the sheet feeding roller 5 until the leading edge thereof is brought into contact with the platen roller 7 in a temporarily rotation-halted state. Thereafter, the platen roller 7 starts rotating with predetermined timing to feed the recording sheet 3a as caught between the platen roller 7 and the printing set 8 for subjecting the recording sheet 3a being fed to printing by printing means (not shown).

Since the feeding force of the sheet feeding roller 5 works on the recording sheet 3a until the platen roller 7 starts rotating, the recording sheet 3a becomes slightly deflected. If the recording sheet 3a is skewed when the recording sheet 3a is brought into contact with the platen roller 7 halted, the contact is made between the recording sheet 3a and the platen roller 7 on one side. If the recording sheet 3a has sufficiently high stiffness, the recording sheet 3a overcomes the restraining forces of the separating rubber member 4 and sheet feeding roller 5 by reaction force resulting from the one-sided contact, with the result that the posture of the recording sheet 3a is corrected

to become orthogonal to the platen roller 7.

On the other hand, if the recording sheet 3a has low stiffness, the reaction force resulting from the one-sided contact is transmitted insufficiently, which causes the recording sheet 3a to be deflected largely. As a result, the recording sheet 3a becomes buckled and is likely to wave. However, the paper feeder of the present invention is provided with the deflection preventive sheet 6 as a major component of buckling preventive mechanism Z for inhibiting buckling of each recording sheet, the deflection preventive sheet 6 extending more broadly than the sheet feeding roller 5 over opposite sides of the separating rubber member 4 where the recording sheet 3a is likely to wave most largely. The provision of the deflection preventive sheet 6 makes it possible to effectively inhibit the recording sheet 3a to buckle and, hence, the reaction force resulting from one-sided contact of the recording sheet 3a with the platen roller 7 is transmitted to the region where the separating rubber member 4 and the sheet feeding roller 5 are located, thereby correcting the posture of the recording sheet 3a. Thus, unlike the conventional paper feeder, the paper feeder of the present invention can obviate wrinkling of even a thin limp recording sheet and hence ensures satisfactory printing.

Fig. 2 shows the constitution of the buckling preventive mechanism Z. The sheet feeding roller 5 and printing set 8 not shown in Fig. 2 (see Fig. 1) are mounted on

the base plate 10. The deflection preventive sheet 6 comprises a stiff portion 6b having relatively high stiffness and a contact portion 6c having relatively low stiffness. The contact portion 6c is positioned downstream of the stiff portion 6b, while the stiff portion 6b is secured as sandwiched between the separating rubber member 4 and the mount 9. The contact portion 6c is formed with slits 6a on opposite sides of the separating rubber member 4. In this embodiment the deflection preventive sheet 6 and the base plate 10 constitutes the buckling preventive mechanism Z, the deflection preventive sheet 6 extending more broadly than the length of the sheet feeding roller 6 outwardly from opposite sides of the separating rubber member 4 in the direction orthogonal to the sheet feeding direction.

With the paper feeder thus constructed, the lowermost recording sheet 3a is separated from the recording sheet stack 3 by the separating rubber member 4 and then fed by the sheet feeding roller 5. On the opposite sides of the separating rubber member 4 the recording sheet 3a is lightly sandwiched between the contact portion 6c of the deflection preventive sheet 6 and the base plate 10. In this way the recording sheet 3a being fed is inhibited to buckle. For this reason, unlike the conventional paper feeder, the paper feeder of the present invention can obviate wrinkling of even a thin limp recording sheet and hence ensures satisfactory printing thereon.

Since the contact portion 6c having relatively low stiffness is positioned downstream of the stiff portion 6b having relatively high stiffness in the deflection preventive sheet 6 as described above, the force of inhibiting waving of a recording sheet grows larger as the waving become larger and, hence, the occurrence of buckling of the recording sheet becomes less likely irrespective of the material of the recording sheet.

Further, the slits 6a,6a formed in the contact portion 6c on opposite sides of the separating rubber member 4 allow the contact portion 6c to contact a recording sheet more flexibly, thereby relieving the resistance to the recording sheet being fed. Thus, the paper feeder of the present invention is capable of feeding a recording sheet smoothly while accommodating possible occurrence of larger waving of the recording sheet. Moreover, the slits 6a,6a allow the operation of securing the separating rubber member 4 and the mount 9 for the ASF sheet 6 to the upper lid (no shown) of the paper feeder with screws to be performed therethrough. Thus, the paper feeder can be assembled with remarkably improved operability.

As apparent from the foregoing description, the present invention has the following advantages.

The provision of the buckling preventive mechanism extending over opposite sides of the separating rubber member makes it possible to prevent a recording sheet from being

deflected. For this reason, the paper feeder of the present invention first prevents even a thin recording sheet having low stiffness from buckling and then brings the leading edge thereof into contact with the skew correction roller halted. Consequently, the reaction force resulting from one-sided contact of the recording sheet with the skew correction roller is transmitted to the region where the separating rubber member and the sheet feeding roller are located, thereby correcting the posture of the recording sheet. Thus, unlike the conventional paper feeder, the paper feeder of the present invention prevents a recording sheet from wrinkling and hence ensures satisfactory printing thereon.

Since the paper feeder of the present invention causes a recording sheet to pass through the gap defined between the deflection preventive sheet comprising the thin flexible sheet having certain rigidity and the base plate of the feeder body with a clearance, the paper feeder can inhibit even a thin recording sheet having low stiffness to be deflected and hence can prevent it from buckling.

Since the deflection preventive sheet is formed to extend more broadly than the length of the sheet feeding roller, the deflection preventive sheet can effectively inhibit a recording sheet to be deflected.

By positioning the contact portion having relatively low stiffness downstream of the stiff portion having relatively high stiffness the deflection preventive sheet can

inhibit a recording sheet to wave more effectively as the waving become larger and, hence, the occurrence of buckling of the recording sheet becomes less likely.

The slits formed in the deflection preventive sheet make it possible to enhance the flexibility of the contact portion, thereby allowing the contact portion to accommodate large waving of a recording sheet more effectively.

By utilizing the slits of the deflection preventive sheet as openings allowing an assembling operation to be performed therethrough, the paper feeder can be assembled with remarkably improved operability.

While only certain presently preferred embodiments of the present invention have been described in detail, as will be apparent for those skilled in the art, certain changes and modifications may be made in embodiments without departing from the spirit and scope of the present invention as defined by the following claims.